

1 CLAIMS:

2 1. A cylindrical magnetron comprising:

3 a target tube;

4 a first endblock comprising,

5 a motor;

6 a gearbox; and

7 a drive assembly between the gearbox and the target tube with one or more
8 axially compliant interfaces between gears of the drive assembly such that the
9 assembly accommodates imperfect rotation of the target tube.

1 2. The magnetron of claim 1 further comprising:

2 a second endblock comprising:

3 an inner housing comprising:

4 a water cooled spindle

5 an electrical transfer system including brush blocks contacting the
6 surface of the spindle.

7 an outer housing;

8 compliant seal rings between the inner and outer housing whereby the
9 inner housing can move within the outer housing to absorb imperfect rotation of the target
10 tube.

1 3. The magnetron of claim 1 further comprising:

2 an inner housing within the first endblock, the gearbox and drive assembly
3 within the inner housing;

4 an outer housing; and

5 compliant seal rings between the inner and outer housing whereby the
6 inner housing can move within the outer housing to absorb imperfect rotation of
7 the target tube.

1 4. The magnetron of claim 3 wherein the imperfect rotation of the target tube
2 includes eccentric rotation about the axis of rotation of the target tube or movement of the
3 target tube along the axis of rotation.

1 5. The magnetron of claim 1 wherein the drive assembly comprises first, second and
2 third gears, the rotating motion from the gearbox transferred from the gearbox to the first
3 gear, the rotating motion from the first gear transferred to the second gear, and the
4 rotating motion from the second gear transferred to the third gear.

1 6. The magnetron of claim 5 wherein the second gear is located between the first and
2 third gear and is electrically insulating.

1 7. The magnetron of claim 5 wherein an axially compliant interface of the one or
2 more axially compliant interfaces is between the first and second gear.

1 8. The magnetron of claim 5 wherein an axially compliant interface of the one or
2 more axially compliant interfaces is between the second and third gear.

1 9. The magnetron of claim 5 wherein the third gear is coupled to the target tube.

1 10. The magnetron of claim 5 wherein the first gear has one or more slots, and
2 wherein one or more protrusions of the gearbox rotate freely within the slots until
3 encountering the end of the slot and thereafter rotate the entire third component.

1 11. The magnetron of claim 10 wherein the one or more protrusions are aligned
2 anywhere within the one or more slots during assembly of the magnetron.

1 12. A sputtering device having a rotating target tube suspended between first and
2 second endblocks, the first endblock having a suspension and drive system comprising:

3 a primary housing;

4 a secondary housing held within the primary housing by insulative and
5 pliable components such that the secondary housing can move within the primary
6 housing, the secondary housing comprising a system of interlocking male and
7 female components rotating about an axis and coupling the gearbox to the target
8 tube.

1 13. The sputtering device of claim 12 wherein the first endblock further comprises a
2 gearbox held within the primary housing by insulative and pliable components such that
3 the gearbox can move within the primary housing.

1 14. The sputtering device of claim 12 wherein the interlocking male and female male and
2 female components are free to move with six degrees of freedom about the axis of
3 rotation.

1 15. A device for plasma coating a substrate having a target tube that rotates about an
2 axis of rotation, the device comprising:

3 a motor;

4 a gearbox;

5 a driveline linking the gearbox and the target tube, the driveline able to pivot
6 about the axis of rotation.

1 16. The device of claim 15 wherein the driveline comprises one or more male and one
2 or more female interconnecting components

1 17. The device of claim 16 wherein one of the male or female interconnecting
2 components is made of an insulating material thereby insulating the motor and gearbox
3 from the target tube.

1 18. The device of claim 15 wherein the driveline is further able to move along the
2 axis of rotation to absorb imperfect rotation of the target tube.

1 19. The sputtering device of claim 15 further comprising a rotating shaft that transfers
2 power to the target tube.

- 1 20. The sputtering device of claim 19 further comprising one or more brush
2 blocks that transfer power to the rotating shaft.
- 1 21. The sputtering device of claim 20 wherein the one or more brush blocks are
2 concentrically disposed about the rotating shaft, and are compressively kept in contact
3 with the shaft.
- 1 22. The sputtering device of claim 19 wherein cooling water flows through the
2 rotating shaft and into the target tube.
- 1 23. The sputtering device of claim 19 wherein a non rotating shaft is within the
2 rotating shaft, and wherein the non rotating shaft locates and supports a magnetic array
3 within the target tube.
- 1 24. The sputtering device of claim 15 further comprising a shield connected to the
2 primary housing and electrically isolated from the primary housing.
- 1 25. The sputtering device of claim 24 wherein the shield comprises an inner shield
2 and an outer shield electrically isolated from each other.
- 1 26. A device for plasma coating a substrate having a target tube that rotates about an
2 axis of rotation, the device comprising:
- 3 an electrical transfer system capable of transferring power to the target tube, the
4 transfer system comprising:
- 5 a shaft electrically contacting and rotating with the target tube;
- 6 a brush block in contact with a first region of the shaft,
- 7 wherein water flows through the shaft and the target tube, and wherein the brush
8 block transfers the power to the shaft and wherein current travels in a path from the
9 brush block through the shaft to the target tube; and
- 10 a non-metallic bearing in the current path and disposed about a second region of
11 the shaft.

- 1 27. The device of claim 26 wherein the electrical transfer system is capable of
2 transferring both alternating and direct current.
- 1 28. The device of claim 26 wherein the second region of the shaft is coated with
2 chromium oxide.
- 1 29. The device of claim 28 wherein the chromium oxide is diamond polished.
- 1 30. The device of claim 26 wherein the shaft is made of 304 stainless steel thereby
2 minimizing the effects of inductive heating.
- 1 31. The device of claim 26 wherein the non-metallic bearing is a ceramic bearing that
2 does not inductively heat.
- 1 32. The device of claim 26 further comprising first and second vacuum seals disposed
2 about the second region of the shaft.
- 1 33. The device of claim 32 wherein the first and second vacuum seals are made of a
2 non metallic material that does not inductively heat.
- 1 34. The device of claim 32 further comprising a switch to detect a breach between the
2 first and second vacuum seals.
- 1 35. The device of claim 26 further comprising first and second water seals disposed
2 about a third region of the shaft, the third region coated with chromium oxide.
- 1 36. The device of claim 35 further comprising a switch to detect a breach between the
2 first and second water seals.
- 1 37. The device of claim 26 wherein the first region is coated with chromium oxide
2 wear resistant coating.
- 1 38. The device of claim 26 wherein the brush block comprises graphite and copper.
- 1 39. The device of claim 26 wherein the brush block comprises four or more discrete
2 radial segments.

1 40. The device of claim 39 wherein the brush block segments are held against the first
2 surface with a spring that can be unhooked to remove the brush block segments.

1 41. The device of claim 35 further comprising a port between the first and second
2 water seals whereby in the event the first seal is breached the water may flow out of the
3 port thereby reducing the pressure on the second water seal.

1 42. A magnetron having a first and second endblock and a rotating target tube, the
2 first endblock comprising:

3 a motor;

4 a gearbox electrically isolated from the motor;

5 a driveline within a first inner housing and having an insulating member
6 connecting the gearbox to the target tube;

7 a first outer housing containing the first inner housing and electrically isolated
8 from the first inner housing.

1 43. The magnetron of claim 42 further comprising a shield electrically isolated from
2 the first outer housing.

1 44. The magnetron of claim 42 wherein the shield comprises an outer shield
2 electrically isolated from an inner shield.

1 45. The magnetron of claim 42 wherein the second endblock comprises a water
2 cooled electrical transfer system within a second inner housing.

1 46. The magnetron of claim 45 wherein the water cooled electrical transfer system is
2 within a second outer housing and is electrically isolated from the second outer housing.

1 47. The magnetron of claim 44 wherein the outer shield protects against heat energy
2 and wherein the outer shield reflects a first fraction of the heat energy in a vacuum and
3 radiates a second fraction of heat energy in a vacuum towards the inner heat shield.

1 48. The magnetron of claim 47 wherein the inner heat shield receives the second
2 fraction of radiated heat energy and radiates a third fraction of the heat energy towards
3 the first outer housing.

1 49. The magnetron of claim 48 wherein the primary housing is internally cooled with
2 forced air.

1 50. An endblock of a cylindrical magnetron having a target tube supplied with an
2 electrical potential, the endblock comprising:

3 an isolation plate having a groove;

4 a shield electrically isolated from the isolation plate and the target tube and
5 positioned between the groove and the target tube such that stray material on a trajectory
6 from the target tube cannot completely fill the groove.

1 51. The endblock of claim 50 wherein the unfilled portion of the groove forms a
2 shadow space preventing electrical transfer between the heat shield and the isolation
3 plate.

1 52. The endblock of claim 50 wherein the unfilled portion of the groove forms a shadow
2 space preventing electrical transfer between the electrical potential supplied to the target
3 tube and other components of the magnetron.

1 53. A magnetron including a rotating target tube for sputtering onto a substrate
2 comprising:

3 a first endblock having means for rotating the target tube, the means for rotating
4 the target tube moveable to accommodate imperfections in the rotation of the target tube.

1 54. The magnetron of claim 53 further comprising a second endblock comprising
2 means for providing electricity to the target tube, the means for providing electricity
3 having water cooling means to cool the second endblock and the target tube.

1 55. The magnetron of claim 53 wherein the means for rotating the target tube
2 comprises interlocking male and female components.

- 1 56. The magnetron of claim 54 wherein the second endblock further comprises
2 means for supporting a stationary magnetic array within the target tube.
- 1 57. The magnetron of claim 53 wherein the means for rotating the target tube
2 comprises means for electrically isolating the target tube from the sputtering process.
- 1 58. The magnetron of claim 54 wherein the first and second endblocks further
2 comprise a means for shielding the endblocks from the sputtering process.
- 1 59. A magnetron having an endblock comprising a water cooled electrical transfer
2 system within an inner housing, the inner housing within an outer housing and electrically
3 isolated from the outer housing, the outer housing electrically isolated from a shield
4 around the outer housing.
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